Amendments to the Drawings:

Please replace the drawings as originally filed with the attached four (4) Replacement Sheets of formal drawings.

Remarks:

Please reconsider the application in view of the above amendments and the following remarks.

1. Objection to the Drawings

The drawings were objected to because a reference numeral in Figure 1 was not described in the specification. The Applicant has submitted formal replacement drawing sheets with this Reply that address the objection. The Applicant would like to thank the Examiner for reviewing the application with the informal drawings originally filed.

2. Objections to the Specification

Several informalities in the specification were noted by the Examiner and these have been addressed as suggested by the Examiner in the amendments proposed above.

3. Claim Amendments - Formalities

The Applicant has made amendments to claims 1 and 27-31 to correct minor informalities and not to change the scope of these claims. In particular, the word "and" was added before the penultimate element of claim 1, and claims 27-31 were renumbered to correct claim numbering errors found in the application as originally filed.

3. Claim Rejections - 35 U.S.C. § 102(b)

Claims 1, 4-8, 17-19, and 21-29 stand rejected as anticipated by Bowden (U.S. Patent No. 5,474,142). With respect to claims 1, 4-8, and 17, The Applicant respectfully traverses the rejection for the following reasons.

Generally, the Applicant's invention is a system to automatically control the rate of release of a drill string into a wellbore during the drilling of the wellbore. The rate of release in some embodiments may be related to a selected drilling parameter, or may in other embodiments be a selected fixed value, or an optimized, dynamically determined value. In the invention, a rotary encoder, rotationally coupled to a rig drawworks drum, generates a signal that corresponds to the position of the rig drawworks drum. The signal is operatively coupled to a controller. The

controller in turn generates a control signal that is used to drive an electric servo motor. The electric servo motor is operatively coupled to a rig brake controller. The controller operates the electric servo motor such that the position with respect to time as measured by the encoder corresponds to the selected rate of release of the drill string.

As particularly recited in claim 1, the Applicant's invention is an automatic drilling system comprising (i) an electric servo motor operatively coupled to a winch brake control; (ii) a servo controller operatively coupled to the servo motor; and (iii) a drum position encoder rotationally coupled to a winch drum. The functionality of the encoder, controller and servo motor are described above. The underlined element of claim 1 will be explained below.

It was asserted in the Office Action that all the foregoing elements are disclosed in Bowden. Applicant respectfully disagrees. First, Bowden does not disclose an electric servo motor, or any form of controller capable of operating an electric servo motor. Bowden, by contrast, discloses a completely mechanical automatic drilling system that operates using pneumatic pressure regulators and pneumatic servos. Element 204 from Bowden, asserted in the Office Action as being an electric servo motor, is in fact described in Bowden as an air motor. See Bowden, col. 7, line 45. Element 90 in Bowden, asserted in the Office Action as being a winch drum position encoder, is in fact a wheel in contact with the winch drum that in turn drives a flexible shaft coupled to a differential gear unit. See Bowden, col. 10, lines 48-61. The differential gear unit is responsive to rate of rotation of the winch drum, not its position, and clearly, such differential gear device is not an "encoder" as such term is ordinarily understood. Element 33 in Bowden, asserted in the Office Action as being a servo controller, is in fact the reference numeral used in Bowden to describe the overall automatic drilling system. See Bowden Fig. 1, among other uses of reference numeral 33 therein. Applicant respectfully points out that the device disclosed in Bowden is used to perform functions similar to those performed by the Applicant's claimed invention, however, the Applicant's invention is a fully electronic system, while the system disclosed in Bowden is essentially all mechanical. Accordingly, none of the elements recited in claim 1 can be disclosed or fairly implied in Bowden. Claims 2-16 ultimately depend from claim 1 and are patentable over Bowden for at least the same reasons advanced with respect to claim 1.

Claim 17 recites a method for controlling a rate of release of a drill string. According to claim 17, the method includes several elements that are not shown in Bowden: (i) measuring a parameter related to rotational position of a drawworks drum; (ii) measuring a parameter related to position of a drawworks brake; and (iii) determining a rate of rotation of the drum from the measurements of drum position. As stated above with respect to claim 1, Bowden discloses an entirely mechanical system for automatic drilling. There is no sensor or device in Bowden that measures a parameter related to position of a winch drum, although arguably the rotation of the drum coupled to the "wheel" (reference numeral 90) might be considered a form of "measuring" such a parameter. However, there is no sensor disclosed in Bowden that measures a parameter related to the operating position of a drawworks brake. The devices disclosed in Bowden only respond to relative pressures on various pressure regulators, and operate an air motor accordingly. The actual position of the air motor (correspondingly coupled to the brake control) in Bowden is not determined or otherwise made use of to operate the drawworks brake, nor is there disclosed any sensor which directly measures the position of the brake control. Accordingly, there is nothing in Bowden that can be used to make the foregoing measurements, nor is there any apparatus that can make the determination of rate of rotation as recited in Applicant's claim 17. Accordingly, claim 17 is patentable over Bowden.

Claims 18-26 (properly renumbered) have been canceled.

Claim 27 (properly renumbered) has been amended to recite that the servo motor is in fact an electric servo motor. As explained above with respect to claim 1, nothing in Bowden discloses or suggests an electric servo motor. None of the associated structure in Bowden, therefore, can be used to operate an electric servo motor. Therefore, claim 27 as amended cannot be anticipated by Bowden. Claims 28-31 ultimately depend from claim 27 and are likewise patentable over Bowden.

Claims 1-4, 7 and 17-29 stand rejected as anticipated by Prior et al. (U.S. Patent Application Publication No. 2004/0226748). Applicant respectfully traverses the rejection. Applicant notes the similarity of the system disclosed in Prior et al., however there are some important differences between the disclosed system and the Applicant's claimed invention. First, with respect to claim 1, Applicant's invention includes an electric servo motor operatively coupled to a winch brake control. It was asserted in the Office Action that element 55 in Prior et

al. is a servo motor. That does not appear to be correct. Element 55 is shown more clearly in Figure 2 of Prior et al. as the actual motor which drives the winch. The motor 55 is used to cause the winch to retract the drilling line 45, thus pulling on the drill string to cause a reaming tool to "ream" (enlarge the diameter) an already drilled well hole. The procedure disclosed in Prior et al. is known as "back reaming" because the drill string is pulled out of the wellbore during such back reaming operation, as contrasted with releasing the drill string into the wellbore, as is performed in conventional drilling. The particular device used to operate the brake control disclosed in Prior et al. is described as "actuated either hydraulically or pneumatically, using, for example, a pneumatic cylinder that is applied by rig air pressure that is modulated by control signals 109 issued by the control system 110...." See Prior et al. page 2, paragraph [0024]. Prior et al. does not disclose or suggest using an electric servo motor, as recited in the Applicant's claims. The foregoing recitation of an electric servo motor is not a trivial or insubstantial distinction between the Prior et al. disclosure and the Applicant's claimed invention. Applicant respectfully notes that in the Background of the Invention in the Applicant's Specification, reference is made to the fact that:

> [a]dapting computer control to conventional drawworks motion control devices has also been difficult. A primary source of the difficulty is the fact that conventional drawworks friction brakes are band-type brakes. As is well known in the art, band-type brakes are self-actuating. This aspect of the typical band-type drawworks has made their response difficult to characterize. As a result, it has been believed by those skilled in the art that computer control of conventional band-type brakes is impracticable. See, for example, Boyadjieff et al., *Design Considerations and Field Performance of an Advanced Automatic Driller*, paper no. SPE/IADC 79827, Society of Petroleum Engineers, Richardson, Tex. (2003).

Applicant notes that conventional actuators, such as pneumatic cylinders and the like have proven to be unsuitable for automatic drilling systems where band brakes are used. Applicant does not make this assertion merely of his own accord, but respectfully points out that the first named author of the foregoing reference was formerly chairman and CEO of Varco, Inc. (now National Oilwell Vacro) one of the world's largest manufacturer of drilling rig equipment and control systems. Applicant is not in a position to determine whether the system disclosed in

Prior et al. functions well for its intended purpose, however, the Applicant also notes that the system disclosed in Prior et al. is intended to be used for back reaming, as explained above, wherein the winch is operated to exert a pull on the drill string, and the brake is used to offset the pull so as to maintain a selected drilling parameter. This action is opposite the intended use of the Applicant's invention, wherein the drill string is released into the wellbore by Earth's gravity, and the winch brake acts against gravity, thus controlling the rate of release. Before the Applicant's invention, it was believed that suitable computerized control of a winch having band brakes for regular drilling (as opposed to back reaming) was impracticable. See the Boyadjieff et al. paper referenced above. The Applicant has determined that an electric servo motor can provide the required degree of precision in control of a winch brake used in conventional drilling, even when the winch is equipped with band brakes. The Prior et al. reference does not disclose or suggest an electric servo motor operatively coupled to the winch brake controller as the solution to the problem of band brakes. Accordingly, Prior et al. cannot anticipate claim 1. Applicant does not herein disclaim applicability of his invention to use in back reaming, however, the Applicant notes that the device shown in Prior et al. is intended to be used for back reaming, and in view of the express statements in the Boyadjieff et al. paper referenced above, there would be no motivation to use the device shown in Prior et al. to emulate the operation of the Applicant's claimed invention.

Claims 2-16 ultimately depend from claim 1 and are patentable over Prior et al. for at least the same reasons advanced with respect to claim 1.

With respect to claim 17, Prior et al. does not disclose "measuring a parameter related to position of a drawworks brake." Measuring a parameter related to the position of the brake is used, as explained in the Applicant's specification, to provide a feedback signal to assure that the electric servo motor operates the brake controller precisely. The only thing disclosed in Prior et al. is that the system controller operates a brake actuator. There is nothing in Prior et al. that requires any determination of the position of the brake, if for no other reason than the system disclose in Prior et al. does not use an electric servo motor to actuate the brake control.

Claim 27 as amended recites that an electric servo motor is coupled to a drawworks winch brake drum actuator. Such structure is neither disclosed nor implied in Prior et al. as

explained above with respect to claim 1. Accordingly, claim 27 cannot be anticipated by Prior et al. Claims 28-31 ultimately depend from claim 27 and are likewise patentable over Prior et al.

The Applicant believes that this Reply is fully responsive to each and every ground of rejection and objection cited in the Office Action of May 23, 2005, and respectfully requests early favorable action on this application.

Respectfully submitted,

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